

IN THE CLAIMS:

- 1 1. (Currently Amended) A method for integrating traffic shaping and link sharing func-
2 tions to enable scaling of a plurality of queues multiplexed to media links of an interme-
3 diate station in a computer network, the queues storing data packets that are destined for
4 the media links, the method comprising the steps of:
- 5 assigning committed information bit rate (CIR) and excess information bit rate
6 (EIR) bandwidth values per queue, along with a shaped maximum bit rate per media link;
- 7 uniformly scaling the EIR bandwidths of all queues sharing a media link so that
8 the sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media
9 link;
- 10 calculating when a queue is next eligible for servicing; and
- 11 storing event notifications in a timing wheel having hash entries identifying a
12 queue, a media link, and a priority, that the event notifications are triggered when a queue
13 is eligible for servicing.

- 1 2. (Original) The method of Claim 1 wherein the step of storing comprises the step of
2 providing a timing wheel having a plurality of fields per time slot, wherein the fields rep-
3 resent different service priorities of queues.

1 3. (Original) The method of Claim 2 wherein the step of providing a timing wheel com-
2 prises the step of configuring pointers to the queues to enable early forwarding of the
3 packets to thereby obviate overhead incurred when searching the timing wheel for other
4 references to the packets.

1 4. (Original) The method of Claim 3 wherein the step of providing a timing wheel fur-
2 ther comprises organizing the timing wheel as a contiguous array of time slots containing
3 pointers to linked lists.

1 5. (Original) The method of Claim 4 wherein the contiguous array is a hash array and
2 wherein the linked lists are hash lists.

1 6. (Original) The method of Claim 3 wherein the step of providing a timing wheel fur-
2 ther comprises organizing the timing wheel as a descriptor ring having a plurality of per-
3 time-slot queues.

1 7. (Original) A system for integrating traffic shaping and link sharing functions to enable
2 scaling of a plurality of queues multiplexed to media links of an intermediate station in a
3 computer network, the queues storing data packets that are destined for the media links,
4 the system comprising:

5 queuing logic configured to organize the queues into class queues of a plurality of
6 queue sets, each queue set coupled to inputs of a sublink multiplexer having an output
7 coupled to a media link via a media link queue; and

8 a queue scheduler configured to assign each class queue committed information
9 bit rate (CIR) and excess information bit rate (EIR) bandwidths, and the media link a
10 shaped maximum bit rate.

1 8. (Original) The system of Claim 7 wherein the queue scheduler comprises a EIR scaler
2 that uniformly scales the EIR bandwidths of all queues sharing a media link so that the
3 sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media
4 link.

1 9. (Original) The system of Claim 8 wherein the queue scheduler further comprises a vir-
2 tual time policer (VTP) configured to determine whether the media links are compliant
3 and to calculate when a queue is next eligible for servicing.

1 10. (Original) The system of Claim 9 wherein the queue scheduler further comprises a
2 timing wheel for storing event notifications that are triggered when a queue is eligible for
3 servicing.

1 11. (Original) The system of Claim 10 wherein the timing wheel is organized as a con-
2 tiguous array of time slots containing pointers to linked lists, wherein each list contains a
3 plurality of entries of queue descriptors.

1 12. (Original) The system of Claim 11 wherein the queue descriptors include a queue
2 index that references a class queue of the queuing logic.

1 13. (Original) The system of Claim 12 wherein the queue descriptors include a media
2 link interface that references a media link coupled to the intermediate station.

1 14. The system of Claim 12 wherein the queue descriptors include a priority value indi-
2 cating a priority level assigned to a queue.

1 15. (Original) The system of Claim 10 wherein the timing is organized as a descriptor
2 ring having a plurality of per-time-slot queues.

1 16. (Original) The system of Claim 15 wherein the descriptor ring comprises an array of
2 time slots, wherein each slot contains a queue-depth index that references a tail of a list of
3 descriptors.

1 17. (Original) A method for integrating traffic shaping and link sharing functions to en-
2 able scaling of a plurality of queues multiplexed to media links of an intermediate station
3 in a computer network, the queues storing data packets that are destined for the media
4 links, the method comprising the steps of:
5 notifying a queue scheduler when each packet is forwarded to a queue;
6 determining if the queue is inactive for a committed information bit rate (CIR)
7 and for an excess information bit rate (EIR);
8 if the queue is inactive for the CIR, activating the CIR and incrementing an ag-
9 gregate CIR bandwidth for a media link;
10 if the queue is not inactive for the CIR, activating the EIR rate and incrementing
11 the aggregate EIR bandwidth for the link; and
12 calculating an EIR scale factor of the link.

1 18. (Currently Amended) The method of Claim 17 further comprising the steps of:
2 retrieving a queue descriptor from the timing wheel, wherein the queue descriptor
3 includes a queue index, a media link interface , and a priority value;
4 comparing a calculated link VTP timestamp of a media link queue with a current
5 real time and burst value to ensure that collisions between an eligible queue and other
6 queues do not cause the media link queue to exceed a configurable limit;

7 if the media link queue does not exceed the configurable limit, issuing a dequeue
8 command to the queuing logic for the eligible queue;

9 in response to the command, dequeuing a packet from the eligible queue;

10 returning a length of the dequeued packet as dequeue status to the queue sched-
11 uler; and

12 if the queue length is non-zero, ~~sesnding~~ sending the dequeued packet to a media
13 controller for loading into the media link queue.

1 19. (Original) The method of Claim 18 further comprising the steps of:

2 periodically sending depth threshold status of the media link queue to the queue
3 scheduler;

4 if the depth threshold status indicates that there are more bits in the media link
5 queue than the link VTP timestamp represents, incrementing the link VTP timestamp;

6 correlating the dequeue status with the issued dequeue command;

7 if a dequeued byte count is non-zero, marking the queue as eligible for servicing;

8 if the dequeued byte count is zero, deactivitating one of the CIR and EIR of the
9 queue; and

10 decrementing one of the CIR and EIR aggregate bandwidths of the link.

- 1 20. (Original) The method of Claim 19 further comprising the steps of:
- 2 recalculating the EIR scale factor for the link;
- 3 calculating the link VTP timestamp;
- 4 calculating a queue VTP timestamp; and
- 5 inserting the queue descriptor onto the timing wheel in the quantum correspond-
- 6 ing to one of the queue VTP timestamp, a next time slot and further in time as determined
- 7 by a deferral heuristic.

1 Pleas add new claims 21 et al.

1 21. (New) A method for operating an intermediate station, comprising:

2 dividing the intermediate station into a plurality of queues multiplexed to a plural-
3 ity of media links, the queues storing data packets that are destined for the media links;

4 storing event notifications in a plurality of time slots within a timing wheel when
5 a queue is eligible for servicing, where each time slot in the plurality of time slots in-
6 cludes a hashed entry, the hashed entry identifying a queue index (Q), a media link inter-
7 face (I), and a priority value (P) for each queue; and

8 upon a timing slot in the plurality of time slots becoming current time, checking
9 each entry in a list associated with the time slot, to determine which packets to send.

1 22. (New) The method of claim 21, further comprising:

2 storing similar entries for the same queue at a first time and a second time, where
3 the second time is further in the future than the first time, and an entry at the second time
4 is a higher priority than an entry at the first time.

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1 23. (New) An intermediate station, comprising:

2 a scheduler with timing slots; and

3 one or more entries within the timing slots, where the entries are hashed entries
4 of identifying a queue index (Q), a media link interface (I), and a priority value (P), and
5 point to a media port and a queue.